

# THE IMPACT OF SHEEP MANURE UTILIZING AS AN INNOVATIVE PRODUCT “BIOSLURRY PLUS TRICHODERMA (BIOS +)” ON BINA MANDIRI FARMER GROUP IN PULOSARI VILLAGE, SUKABUMI DISTRICT

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## ABSTRACT

Fertilizer scarcity is still a major problem in agriculture in Indonesia. Furthermore, to overcome the scarcity of fertilizers, the use of chemical fertilizers is expected to be replaced by using organic fertilizers such as Bio Slurry. This innovative product could solve the problem of fertilizer scarcity that occurs among farmers in Indonesia. The utilization of sheep manure to produce innovation product “Bioslurry Plus Trichoderma (BIOS +)” is a program of CSR from PT PLN Indonesia Power PLTP Gunung Salak Kamojang POMU in the form of community development activities. The location of community service was taken at the Bina Mandiri group in Pulosari Village, Kalapanunggal District, Sukabumi Regency. The implementation methodology is designed for mentoring with a participatory approach which consists of: (1) Providing information related to the benefits of innovative products BIOS +, (2) Providing information how to make and apply BIOS +, (3) Practice of applying BIOS + on their cultivated land, and (4) Observation the impact of using BIOS + on soil conditions, cost efficiency, changes in knowledge and changes in behavior of Bina Mandiri group. According to the BIOS+Innovation production implemented by CSR PT PLN Indonesia Power PLTP Gunung Salak Kamojang POMU, the following conclusions are: 1) Bina Mandiri has been successfully maximized their asset in this program, 2) the BIOS + empowerment program resulted in a reduction of chemical fertilizer use on their cultivated land by 185 kg, 3) The improvement of soil and environmental conditions after using BIOS+ from the total land owned by 15 members is 4.14 hectares of horticultural crops, 4) the efficiency of reducing the cost of chemical fertilizers per 3 months is IDR 3,700,000, 5) the Increase in of Bina Mandiri Group's technical knowledge in producing BIOS+ after program implementation is 100%. This exceeded the program's target, and 6) the increase in behavior to apply the innovation product BIOS+ in Bina Mandiri Group is 60%. This exceeded the program's target.

**Keywords:** *bioslurry, innovative product, sheep manure utilizing, trichoderma.*

## 1. INTRODUCTION

Fertilizer is one of the main inputs in increasing agricultural production. Appropriate fertilizer use can increase crop productivity by 30-40 percent and can increase farmers' income (Directorate of Fertilizers and Pesticides, 2004). This is because fertilizer as a means of production is very strategic for farmers and encourages the government to carry out fertilizer subsidy policies for smallholder agriculture. To provide fertilizer at the farm level, it is necessary to meet the 6 principles, namely: right place, right type, right time, right amount, right price and right quality. The fertilizer subsidy policy that continues to increase every year leads to inefficient use of fertilizer by farmers. This can lead to inaccurate targeting of fertilizer subsidies that should be received by small farmers but are also received by other parties (World Bank, 2008). The implementation of the subsidized fertilizer policy is not easy because there is a gap between the policy rules and the operations that occur in the field. This condition was also stated by Minister of

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Agriculture Anton Apriyantono in the 2008 National Congress of the Indonesian Society of Food Technologists in Palembang, where the deviation was caused by a high gap between demand and production. This leads to the difficulty of farmers to obtain urea fertilizer, especially at the beginning of the planting season (in 2008, 9 million tons of urea were needed, but only 5.7 million tons were available). This condition was exacerbated by farmers scrambling to get urea fertilizer at subsidized prices.

Fertilizer scarcity is still a major problem in agriculture in Indonesia. Furthermore, to overcome the scarcity of fertilizers, the use of chemical fertilizers is expected to be replaced by using organic fertilizers. However, the problem is that raw materials for organic fertilizers tend to be scarce. On the other hand, the high population of sheep is potential for making organic fertilizer. For this reason, an innovative product for liquid fertilizer from sheep manure (Bio Slurry) is needed. This innovative product can be the main solution to solve the problem of fertilizer scarcity that occurs among farmers in Indonesia. The potential to develop this product is very high. That is because one sheep produces manure with an average amount of 5-10 kg / day. One sheep can produce 1 liter of Bioslurry. Physically, the characteristics of sheep manure can be known based on the form (solid, semi-solid and liquid), texture (compactness) and amount (kg per sheep unit) produced (Palallo, et al 2018).

Bio Slurry is the final manure produced from sheep manure produced using a degister. Although it is called manure, Bio Slurry still contains many nutrients that are beneficial to the soil and can be used as organic fertilizer. There are 2 types of Bio Slurry, which are solid and liquid. Bio Slurry as an organic fertilizer has high organic material which is useful in improving soil structure. Soil that is given Bio Slurry products becomes looser and easily absorbs nutrients and water. This product can also moisturize hard soil. Bio Slurry is able to produce several nutrients needed by sheep to soil and plants consisting of macro nutrients and micro nutrients. Macro nutrients consist of Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), and Sulfur (S). Meanwhile, micro nutrients consist of Iron (Fe), Manganese (Mn), Copper (Cu), and Zinc (Tim Biru, 2021).

The sheep manure utilization program that has been fermented in the form of Bioslurry Plus Trichoderma (BIOS +) is a CSR program of PT PLN Indonesia Power PLTP Gunung Salak Kamojang POMU in the form of community development activities. The innovative product developed through the program in this independent development group is called BIOS +, which is a combination of Bioslurry content with Trichoderma fungi. Trichoderma, sp, this microorganism is a soil-dwelling fungus that can be isolated from the roots of field plants. Trichoderma, sp can be a decomposing organism and can also function as a biological agent and plant growth stimulator. Trichoderma, sp can inhibit the growth of fungi that cause diseases for plants such as the fungus *Rigidiforus lignosus*, *Fusarium oxysporum*, *Rizoctonia solani*, *Fusarium monilifome*, *sclerotium rolfsii* and *Sclerotium rilfisol* fungus. The use of biological fertilizers and biological agents Trichoderma, sp is very effective in preventing stem base rot, root rot that causes plants to wilt, and white root fungal disease in plants. This innovative product has the potential to be a solution to reduce the use of chemical fertilizers that are expensive and not environmentally friendly. This innovative product is also able to repair soil nutrients that are damaged due to excessive use of chemical fertilizers.

## 2.METHODOLOGY

The location of community service was taken at the Bina Mandiri group in Pulosari Village, Kalapanunggal District, Sukabumi Regency. The determination of this location is because these areas are the neighborhoods around PT PLN Indonesia Power PLTP Gunung Salak Kamojang POMU. To explore community problems, the CSR Team of PT PLN Indonesia Power PLTP

Gunung Salak Kamojang POMU and academics from Malikussaleh University held in-depth discussions with the Bina Mandiri group in Pulosari Village, Kalapanunggal District, Sukabumi Regency. The implementation methodology is designed for mentoring with a participatory approach and refers to the adult-learning process which consists of: (1) Providing information related to the benefits of innovative products BIOS +, (2) Providing information related to how to make BIOS + and how to apply it, (3) Practice of applying BIOS + on land owned by Bina Mandiri group, and (4) Observation of the impact of using BIOS + on the land of Bina Mandiri group on soil conditions, cost efficiency, changes in knowledge and changes in behavior of Bina Mandiri group.

## 2.1. Tools And Material

- a. Tools used in the manufacture of Innovative Products BIOS+
  - Storage Drum: Holds BIOS+ results
  - Fermentation Drum: Place for fermentation of ingredients
  - Biogas Degester: Fermentation of feces and urine
  - Plastic bucket: Take Bioslirry
  - Plastic: Seal the storage drum for airtightness
- b. Materials:
  - Sheep Feces
  - Sheep Urine
  - Banana Stem Waste and Coconut Coir Waste
  - Trichoderma Sp
  - Papaya Leaf
  - Water 1:3 ratio

## 2.2. Data Collection Stage

Field data collection for preliminary calculations is required at this stage. This field data is collected by observing Pulosari Village, where Bina Mandiri Farmer Group operates. These data are presented in the following table:

- a. Data on Bina Mandiri Farmer Group members who own sheep.
- b. The Bina Mandiri farmer group member's land ownership data
- c. Total sheep/sheep data.

## 2.3. Production stage of BIOS+

The BIOS+ manufacturing process is performed by separating the BIOS+ solids and liquids, then sun drying or air drying the BIOS+ solids to obtain a dry and solid fertilizer. (Andhika, 2020). Dried BIOS+ samples were collected from 5-6 different locations with different weights, the BIOS+ samples were placed in plastic bags, and then the fertilizer samples were re-combined in a large plastic bag. The samples were shaken and swirled back and forth until completely homogenized as shown in the following figure:

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Figure 1. Process flow of BIOS+ establishment (Setyaningsih, 2019)

**2.4.Observation of program's impact on knowledge changes, behavior changes, soil and environmental improvement levels**

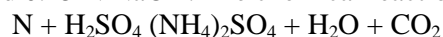
In this phase, several tests were conducted using specific instruments to see the impact of the program on changes in knowledge, behavior, soil and environmental improvement scores. The impact of the program on the changes in knowledge and behavior will be tested using an instrument in the form of an open-ended questionnaire (1-5) regarding the understanding and changes in behavior of the training participants regarding the materials and practices presented in this training. The expected impacts of the service activities are:

1. Increased knowledge of the Bina Mandiri group regarding Bios+ products > 50%;
2. Increased behavior of Bina Mandiri group to practice making Bios+ products by > 50%;

Furthermore, laboratory tests were conducted by taking soil samples before and after the use of BIOS+ to see the impact of the program on soil and environmental improvement levels. Data were collected from the results of testing sheep manure samples, sheep in the test reactor. The required data is as follows:

- a. Quantity of animal manure used as raw material
- b. Information on the length of time required for the fermentation process in the digestion tank
- c. The total production of BIOS+ as a crop fertilizer.

The principle for total nitrogen determination is Nitrogen in sample is decomposed with H<sub>2</sub>SO<sub>4</sub> (p) to (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>. Salt (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> formed by adding 40% NaOH is distilled to NH<sub>3</sub>. The distillate is absorbed by excess 0.25 N H<sub>2</sub>SO<sub>4</sub> and the excess H<sub>2</sub>SO<sub>4</sub> is rediluted with standard 0.25 N NaOH. The chemical reaction is as follows:



The extract filtrate of the fertilizer sample is reacted with a mixed reagent consisting of ammonium molybdate and ammonium vanadate (1:1) in an acidic state. The phosphate ions present



in the sample will react with the molybdic acid to form molybdophosphoric acid. Molybdophosphoric acid is reacted with ammonium vanadate to form vanadomolybdophosphoric acid, which is colored yellow. It is then analyzed with a spectrophotometer using visible light at a wavelength of 466 nm. The phosphate concentration in the solution is proportional to the intensity of the yellow color. Data is also analyzed by comparing the average amount of sheep manure per day (raw materials). So we can estimate how much fertilizer can be produced to be used as a substitute for chemical fertilizers in crops.(Wardana & Lukman, 2021)

### 3.RESULTS AND DISCUSSION

The benefits of fertilizers are related to the chemical properties of the soil, the benefits of fertilizers that are most widely felt are to provide nutrients needed by plants, help prevent the loss of nutrients that are quickly lost such as nitrogen, phosphorus and potassium, and can improve soil acidity. (Mujiyo & Suryono, 2017). The program of utilizing sheep manure into an innovative product “BIOS+” was implemented at the Bina Mandiri Group in Pulosari Village, Kalapanunggal District, Sukabumi Regency. The following figure shows the BIOS+ product innovation:

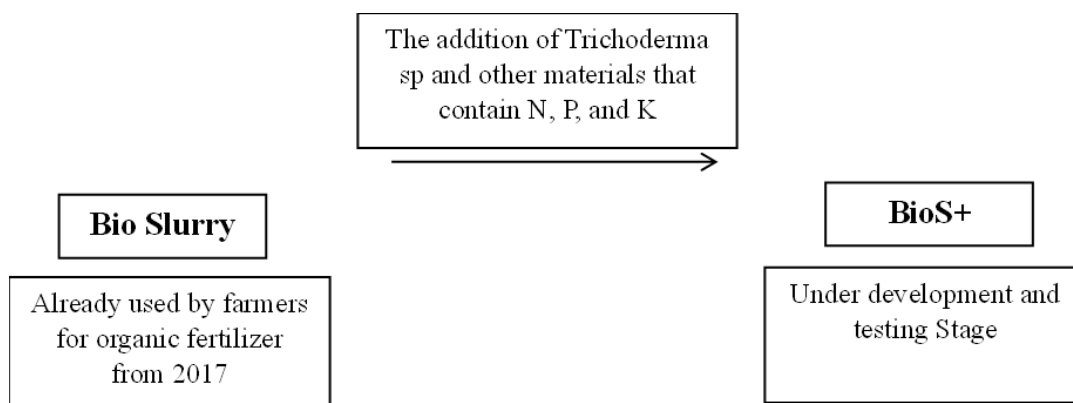


Figure 2: Innovation flow of BIOS+ products (Setyaningsih, 2019)

BIOS+ also increased soil microbial population and activity. The average nitrogen content of BIOS+ was higher in the liquid [wet] than in the solid [dry] forms. Comparing the nutrients in BIOS+ shows that nitrogen tends to be higher than phosphorus and potassium. Furthermore, BIOS+ contains probiotic microbes that can improve soil fertility. This affects the quality and quantity of crop yields. The following table shows the results of the study:

Table 1: Number of Sheep in Bina Mandiri Farmer Group Members

No.	Name	Cultivated area (m <sup>2</sup> )	Total of Sheep
1	Manah	5000	5
2	Fandi	1000	4
3	Huri Alfarizi	5000	5
4	Samsuri	1000	4
5	Didi	800	12
6	Abbas	1500	5
7	Owin	4000	5
8	Ojan	5000	8
9	Ruswana/uhe	3000	4

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10	Sutiawan	700	2
11	Radian	1500	10
12	Patma	300	2
13	Rudiat	600	2
14	Suganda	7000	7
15	Ade Iwan	5000	8

Data Source: Field Observation

The number of members, the area of agricultural land and the number of sheep owned by the members of Bina Mandiri Farmer Group can be seen in Table 1. Bina Mandiri group has assets of 80 sheep, company assets 1 digester unit 4 m<sup>3</sup>. Which has been successfully maximized to 40 sheep, 1 digester unit with 1000 liters / month production. The installation of the digester can be seen in the following picture:



Figure 3. Digester Installation for BIOS+ Product Manufacture

All assets owned by Bina Mandiri Group have been used optimally during this program. In this program, academics and CSR together provide knowledge to Bina Mandiri group on how to make BIOS+ as seen in the following picture:



Figure 4.

- a) The process of providing information about the benefits of BIOS+ by academics to the Bina Mandiri group.
- b) The process of directly practicing the production of BIOS+ The process of providing information on the benefits of BIOS+ was presented using PowerPoint and videos.

Furthermore, the practical process of BIOS + production was directly guided by CSR PT PLN Indonesia Power PLTP Gunung Salak Kamojang POMU. The BIOS+ manufacturing process is as follows:

- a. Sheep produce fresh manure, which is then diluted with water;
- b. Then N, P and K elements are added from compost/vegetable material sources that are readily available in the surrounding environment such as banana waste and waste/coconut fibers, sugar cane etc;
- c. The liquid flowed into digester for fermentation for 15 days;
- d. Next, anaerobic (airless) fermentation occurs inside the digester.
- e. Then the final product produced is BIOS+, which is ready to use and packaged as shown in the following figure:
- f.



Figure 5. product BIOS+ from Bina Mandiri Group Empowerment program

Bina Mandiri has been advised to use BIOS+ as an organic fertilizer to replace chemical fertilizer. Sheep manure in the form of dung and urine is found to contain organic matter (Putri, 2019). This content is a potential source of nutrients that can be used to produce organic fertilizer. In accordance with the research of Fitriyah (2021) which states that BIOS + itself is a natural fertilizer that contains a lot of nutrients, because BIOS + is a fertilizer that is able to bind soil nutrients while loosening hard soil, because the process of processing in biogas makes BIOS + as a fertilizer that is rich in nitrogen compared to phosphorus and potassium. The BIOS+ product from

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this program is known under the name “**Permaisuri Prima**”. This product has been used by the Bina Mandiri Group on their agricultural land as shown in the table below:

Table 2. Amount of BIOS+ used to replace chemical fertilizers based on cultivated area

No	Name	Cultivated area (m2)	BIOS+ utilization (liters)
1	Manah	5000	20
2	Fandi	1000	15
3	Huri Alfarizi	5000	24
4	Samsuri	1000	20
5	Didi	800	15
6	Abbas	1500	30
7	Owin	4000	100
8	Ojan	5000	100
9	Ruswana/uhe	3000	100
10	Sutiawan	700	60
11	Radian	1500	80
12	Patma	300	0
13	Rudiat	600	100
14	Suganda	7000	150
15	Ade Iwan	5000	150
Total			964 liters

Data Source: Field Observation

Based on Table 2, we can see the level of BIOS+ use based on cultivated area of Bina Mandiri group members to reduce the use of chemical fertilizers (Mujiyo & Suryono, 2017). The Labotarium test of the components included in BIOS+ is shown in the following table:

Table 3. Components which included in BIOS+

MAKRO NUTRITION	MIKRO NUTRITION
Nitrogen (N)	Ferrum (Fe)
Phosphor (P)	Manganese (Mn)
Potassium (K)	Cuprum (Cu)
Calcium (Ca)	zinc (Zn)
Magnesium (Mg)	-
Sulphur (S)	-

Data Source: B.Stata Data

Besides the above nutrients, 1 kg of BIOS+ also contains 3.000 mg of vitamin B12. BIOS+ also contains amino acids, B vitamins, several hydrolase enzymes, growth hormones and humic acids that are beneficial for plant growth and development (B.Satata, 2016). Table 3 also shows the amount of nutrients that can be produced by sheep manure. Furthermore, the impact of the use of chemical fertilizers before and after the implementation of the empowerment program can be seen from this program. The use of chemical fertilizing before the application of BIOS+ can be seen as follows:



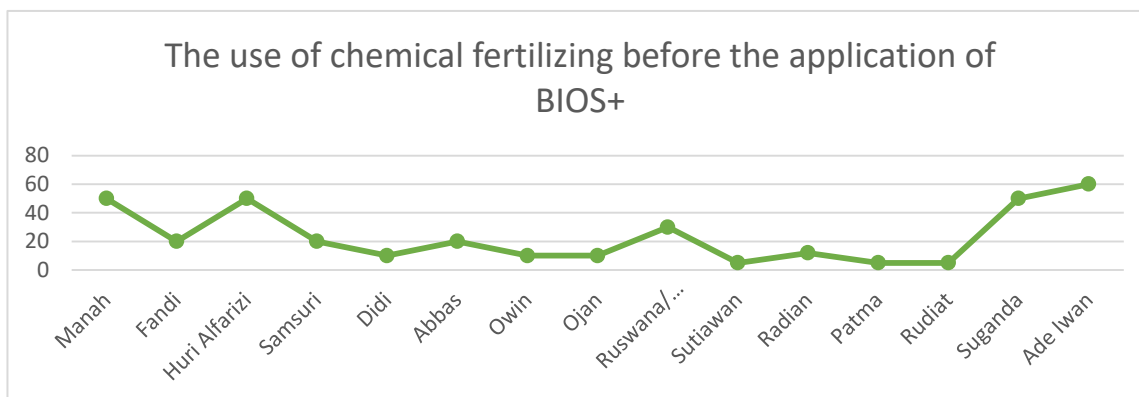


Figure 6. The use of chemical fertilizing before the application of BIOS+

Based on Figure 6, there are 15 group members who raise sheep and have agricultural land where the group members still have high use of chemical fertilizers. In plant cultivation, the use of fertilizers can be useful to provide nutrients to plants, the provision of fertilizers can also improve soil quality to make it more fertile and replace nutrients lost from the soil. The most commonly used fertilizer is chemical fertilizer. A chemical fertilizer is a type of fertilizer that can provide these types of benefits. chemical fertilizer are higher and more persistent. However, the effects of continuous application of chemical fertilizers are very dangerous. (Sanjaya, 2015). Heavy use of chemical fertilizers can damage soil and environmental conditions when used in large quantities and on a continuous basis. Therefore, reducing chemical fertilizers by using BIOS+ is the right solution. As sheep production continues to increase, it is expected that the use of chemical fertilizers will one day be effectively minimized. The reduction in the use of chemical fertilizers after the use of BIOS+ in Bina Mandiri Group is as follows.

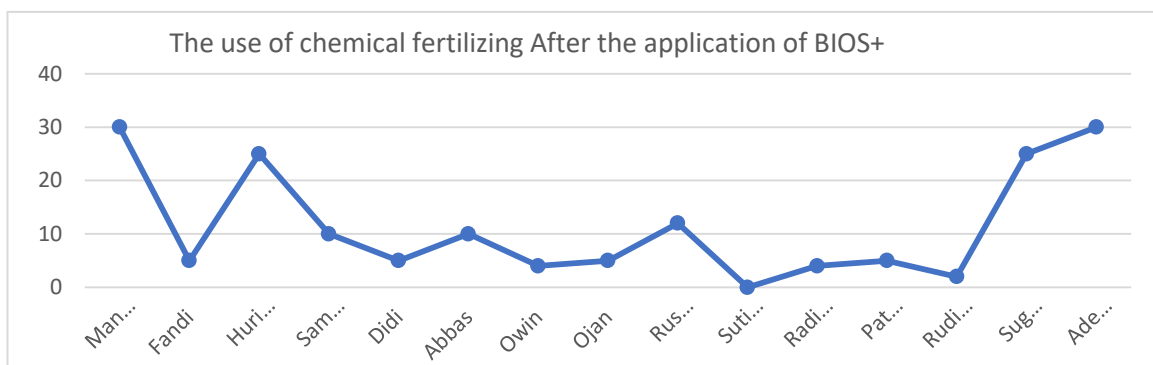
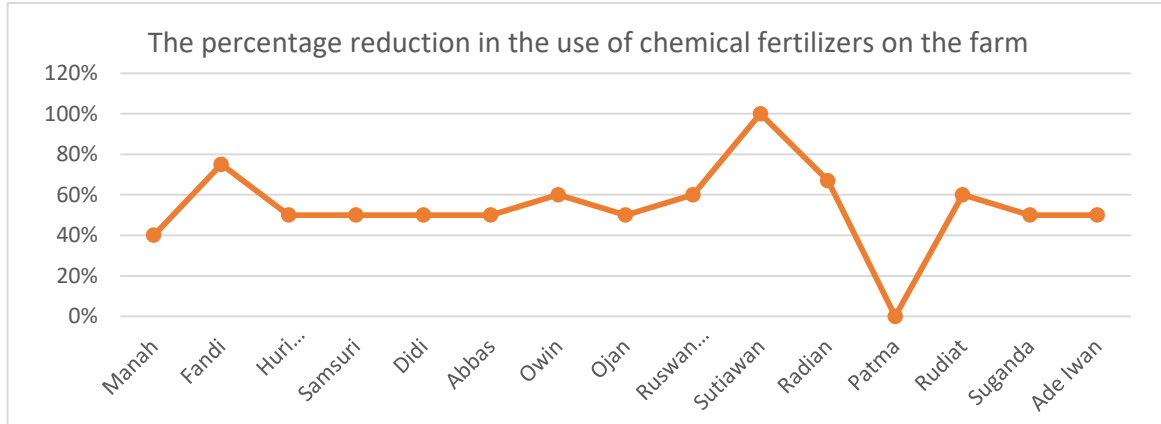


Figure 7. The use of chemical fertilizers in the Bina Mandiri group of farms after the application of BIOS+

After the group members were trained to use BIOS+, the use of chemical fertilizers decreased. This means that the Bina Mandiri group is increasingly aware that excessive use of chemical fertilizers can damage the nutrients in the soil. Based on Figure 6, we can see that there is a significant decrease in the use of chemical fertilizers by Bina Mandiri members on their farms, as shown in Figure 7.

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Gambar 8. The percentage reduction in the use of chemical fertilizers on their farm.

Figure 8 shows that most of the participants in this program reduce the amount of chemical fertilizers as more than 40% after using BIOS+. It's also means that most of them has increased their awareness of the excessive use of chemical fertilizers which will cause damage to the soil conditions and nutrients. Hopefully it will inspire other farmers to produce BIOS+ from sheep manure. The observation showed that the improvement in soil condition of the Bina Mandiri group after the use of BIOS+ was 4.14 hectares of horticultural crops from the total land (15 people) of the program participants. Besides the high nutrient content, BIOS+ can also maximize the Bina Mandiri group's cost efficiency in farming. It is calculated that before the use of BIOS+, the total consumption of non-subsidized chemical fertilizer by the members amounted to 357 kg. After implementing BIOS+, the Bina Mandiri group used 172 kg of chemical fertilizer. This means that the cost for the purchase of chemical fertilizers has been reduced by 185 kg. Assuming Pearl NPK per kilogram is 20,000, the efficiency of reducing fertilizer cost per 3 months is IDR. 3,700,000.

The impact of the Community Empowerment Program on increasing knowledge among 15 Bina Mandiri group members is demonstrated by 100% of Bina Mandiri group members increasing technical knowledge of BIOS+ production after program implementation, as shown in the following figure:

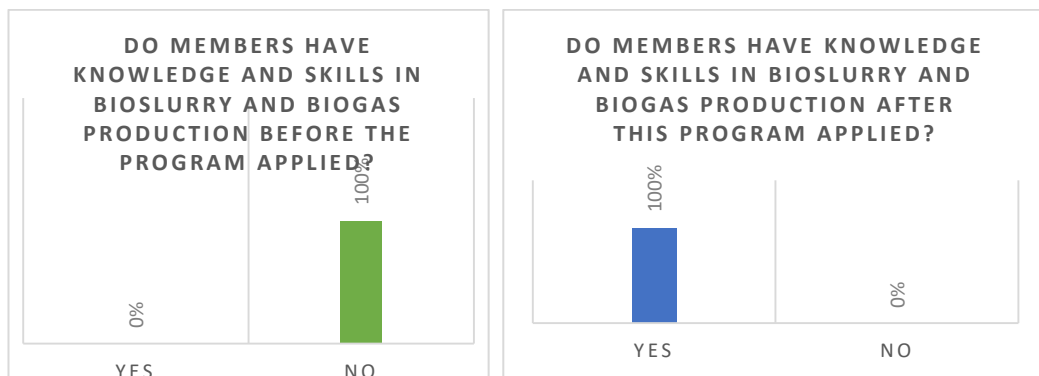


Figure 9. The Increase in of Bina Mandiri Group's technical knowledge in producing BIOS+.

While the impact of this program on increasing the behavior of Bina Mandiri Group to produce innovative production BIOS+ showed that 9 out of 15 (60%) members of the group, after the training, apply the practice of producing BIOS+, as shown in the picture below:

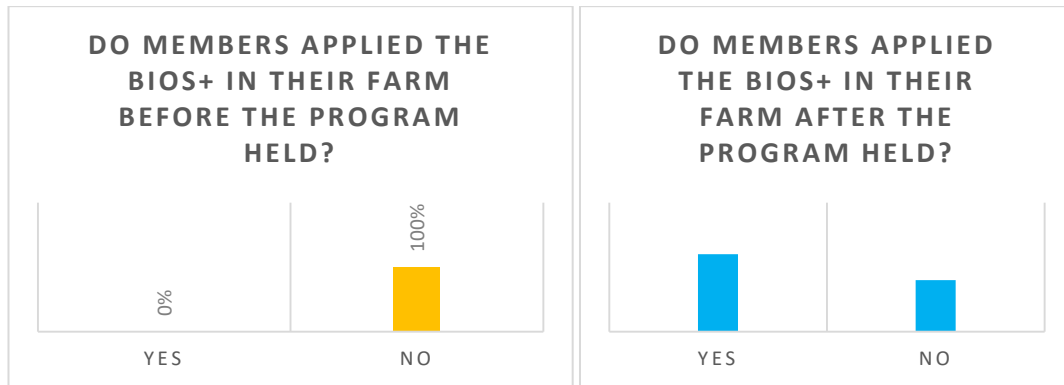


Figure 10. The increase in behavior to apply the BIOS+ in Bina Mandiri Group.

The ultimate goal of this program is that the Bina Mandiri Group of PT PLN Indonesia Power PLTP Gunung Salak kamojang POMU will be able to sustainably process its sheep manure into environmentally friendly BIOS + to replace the continued use of chemical fertilizers that can harm the environment.

#### 4.CONCLUSION

According to the BIOS+Innovation production implemented by CSR PT PLN Indonesia Power PLTP Gunung Salak Kamojang POMU, the following conclusions are made:

1. Bina Mandiri Group has assets of 80 sheep, company assets 1 digester unit 4 m<sup>3</sup>. Which has been successfully maximized to 40 sheep, 1 digester unit with 1000 liters / month production;
2. The BIOS + empowerment program resulted in a reduction of chemical fertilizer use on their cultivated land by 185 kg;
3. Improvement of soil and environmental conditions after using BIOS+ from the total land owned by 15 members is 4.14 hectares of horticultural crops;
4. The efficiency of reducing the cost of chemical fertilizers per 3 months is IDR 3,700,000.
5. The Increase in of Bina Mandiri Group's technical knowledge in producing BIOS+ after program implementation is 100%. This exceeded the program's target.
6. The increase in behavior to apply the innovation product BIOS+ in Bina Mandiri Group is 60%. This exceeded the program's target.

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